Characterization of Commercially Available 50-W UFO LED Plant Lighting for Use in NASA's Habitat Demonstration Unit

Gioia D. Massa[1], Kenneth D. Mellott[1], Gary W. Stutte[2] and Raymond M. Wheeler[1]

1. NASA Kennedy Space Center, Surface Systems Division
2. Kennedy Space Center, ESC Team QNA

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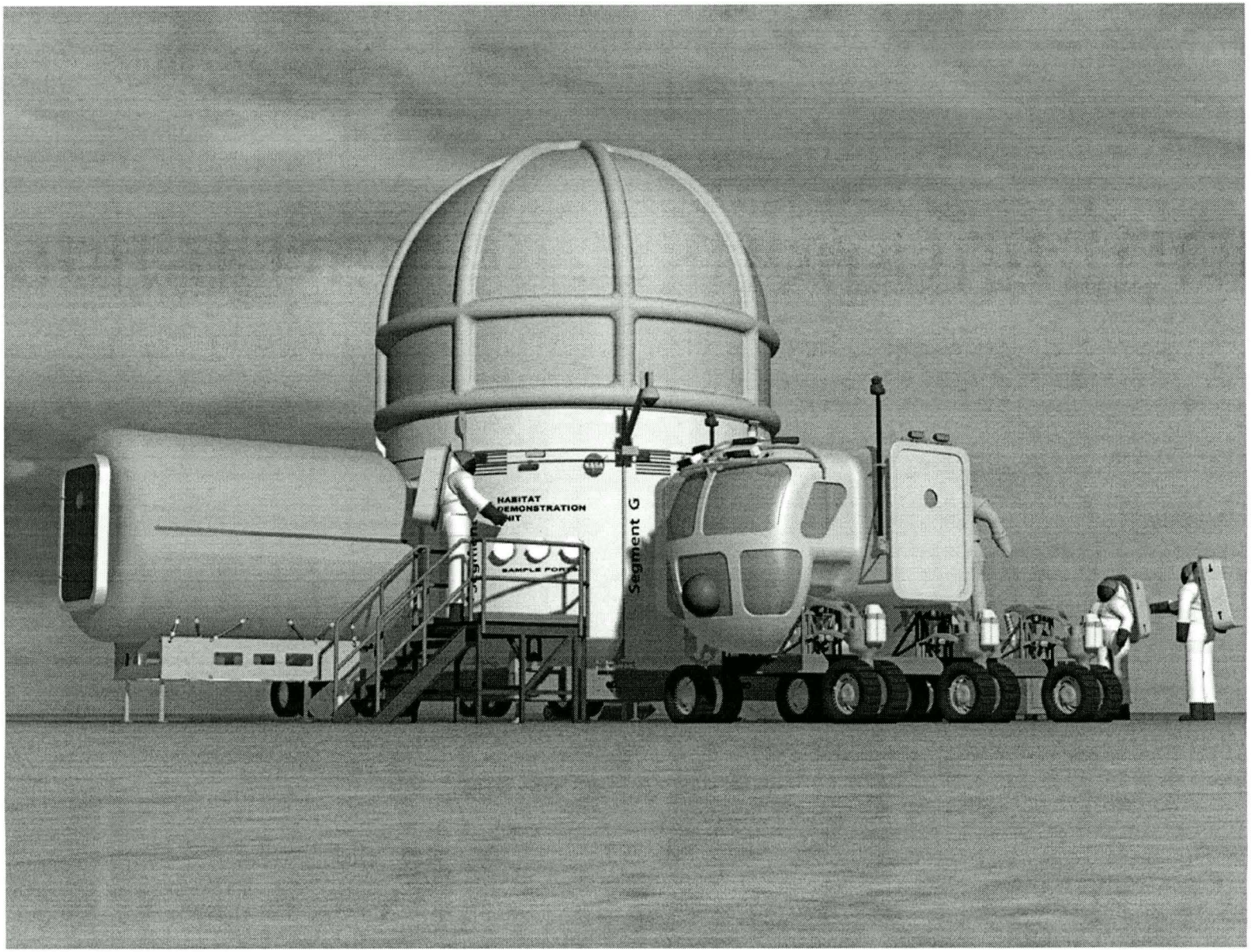
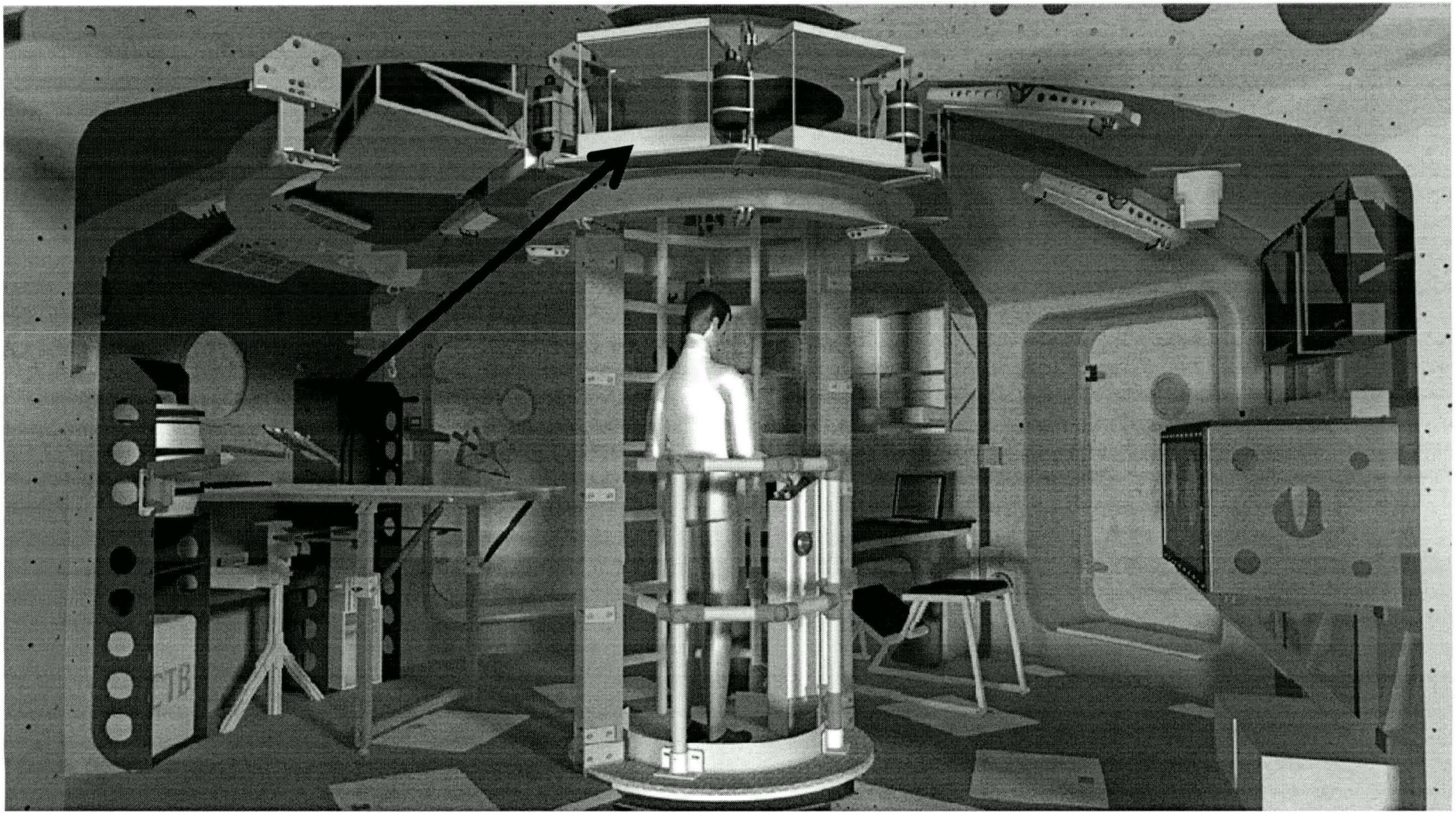
Habitat Demonstration Unit (HDU)



Plant Atrium Concept



Lighting Constraints

- Narrow time window
- Small budget

} COTS

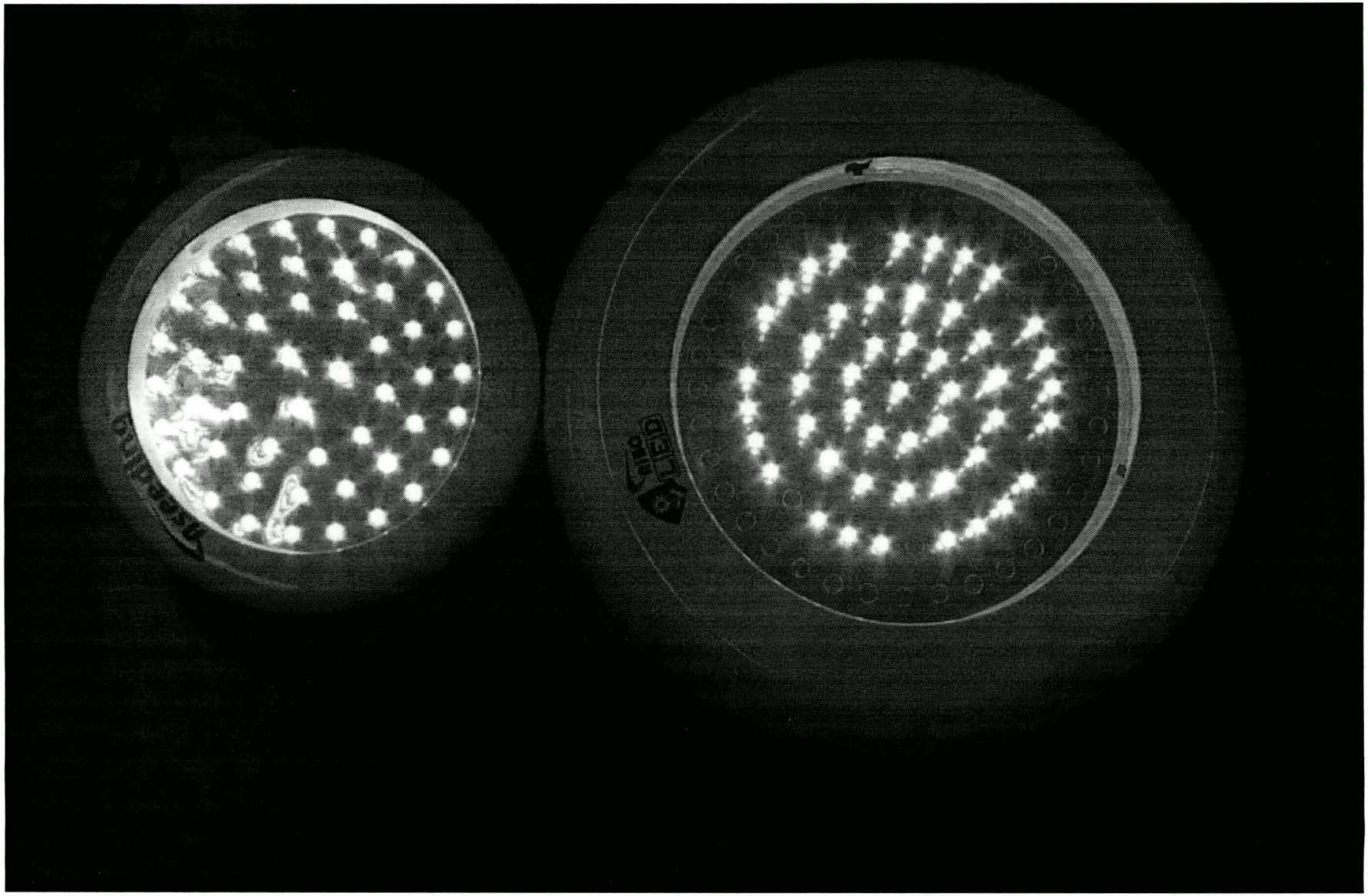
- Small vertical distance
- Thermal/air flow issues

} Solid State (LED)

- Ease of integration
- Low power demands

} 50 W, 110 V

Initial 50 W UFO LEDs



Specifications

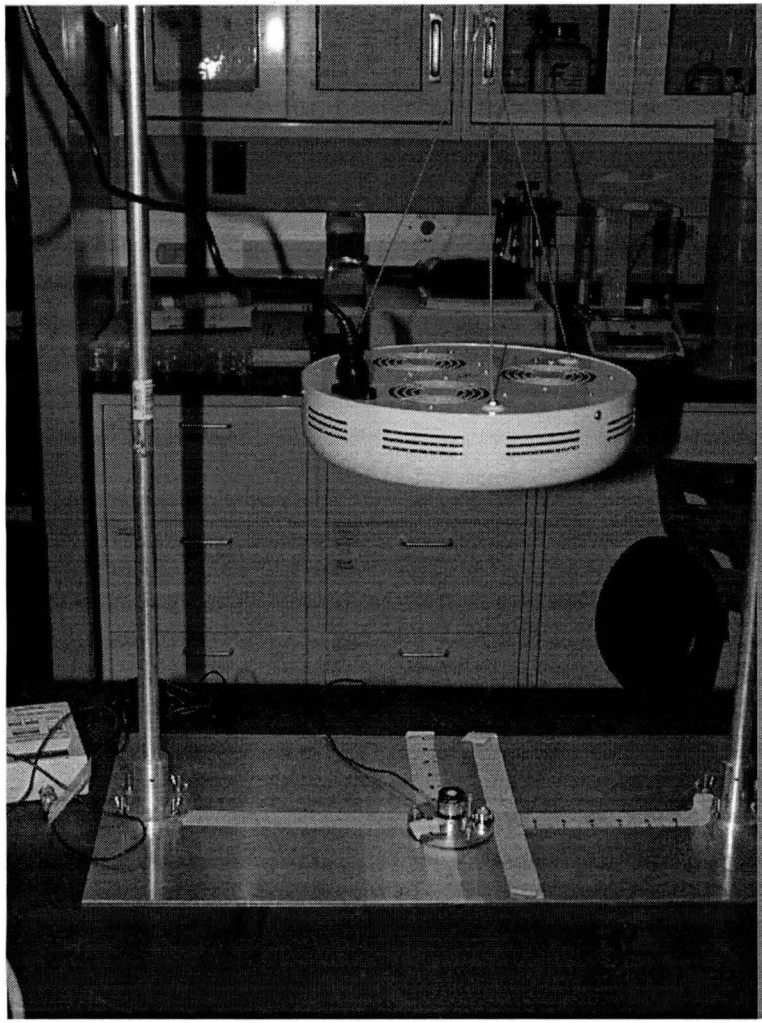
Small (Aseeding) UFO

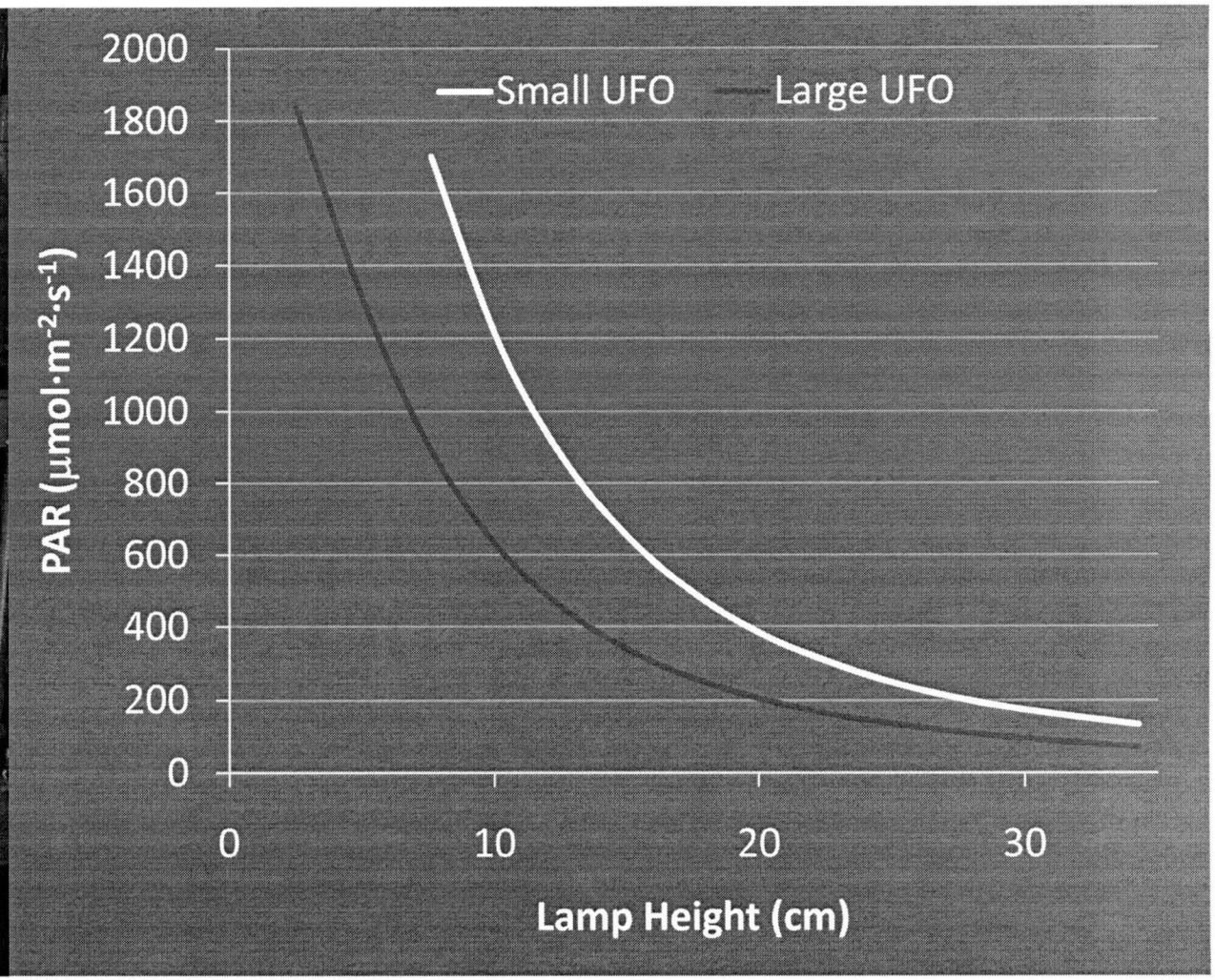
- 50 W rating, 110 V AC
- 15.24 cm diameter
- 50 LEDs
  - 44 Red (630 nm)
  - 6 Blue (460 nm)
- 50W AIBC Aseeding RB81-630

Large UFO

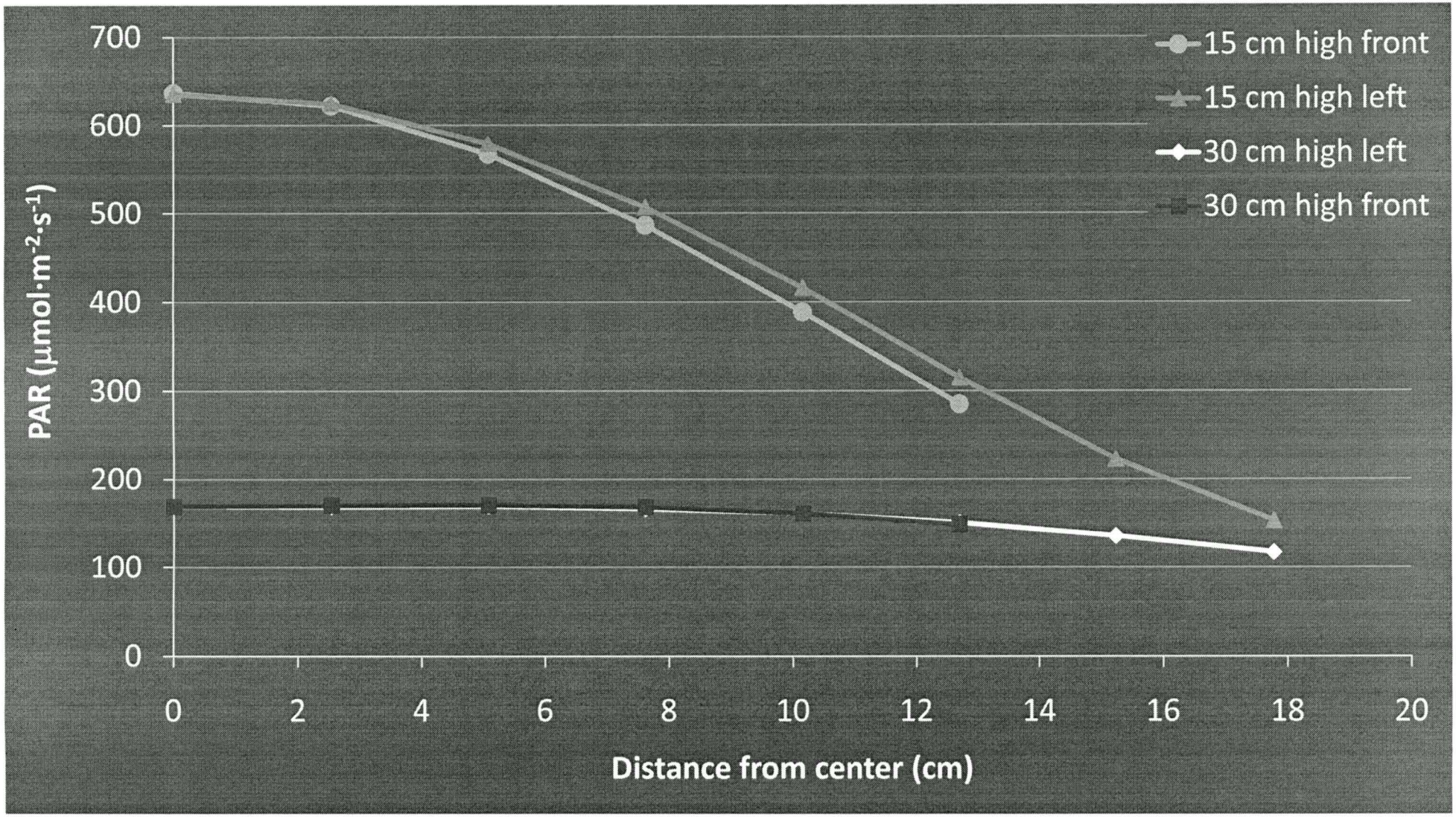
- 50 W rating, 110 V AC
- 26.7 cm diameter
- 48 LEDs
  - 43 Red (630 nm)
  - 5 Blue (460 nm)
- 50W AIBC-RB81-630

UFO PAR Output



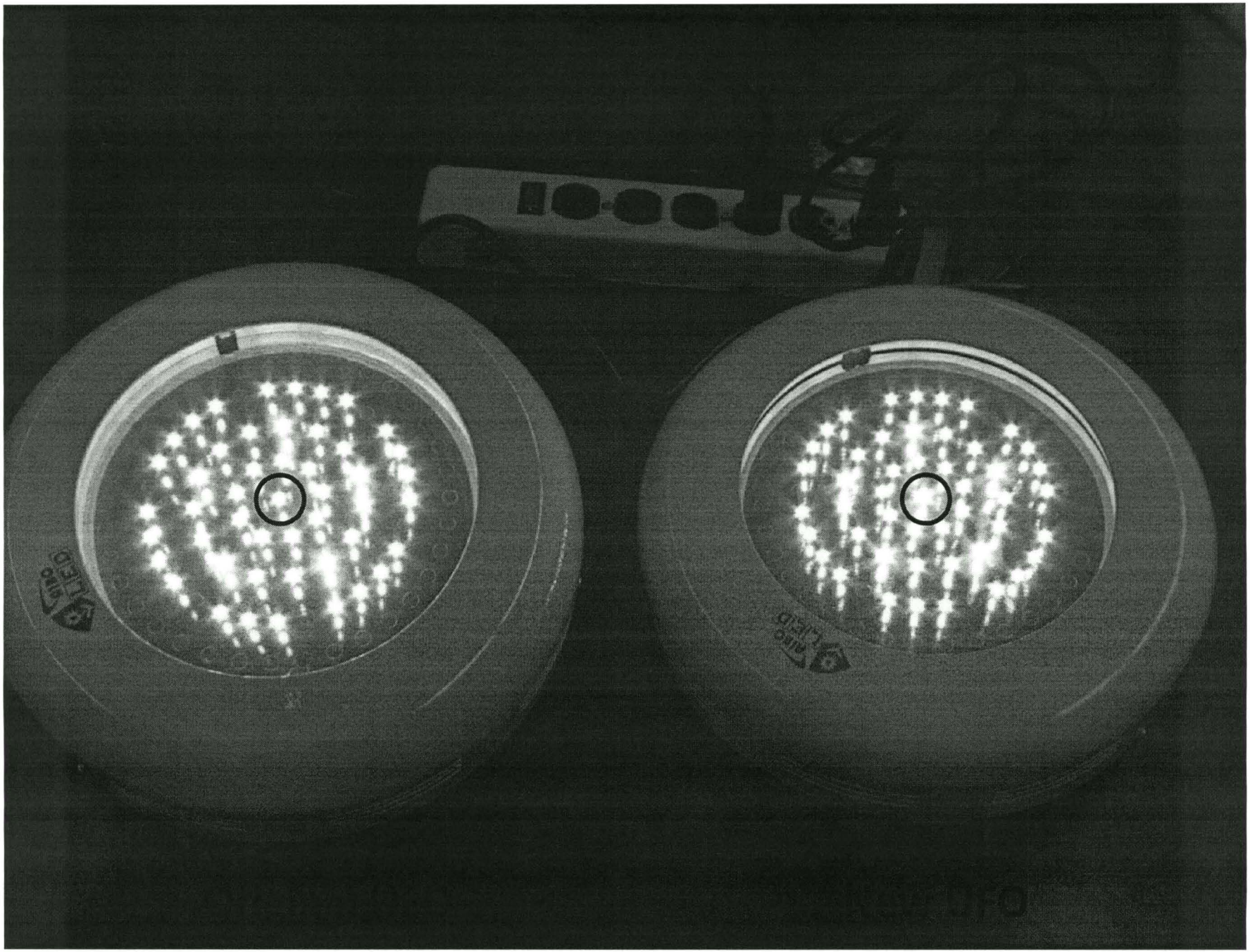


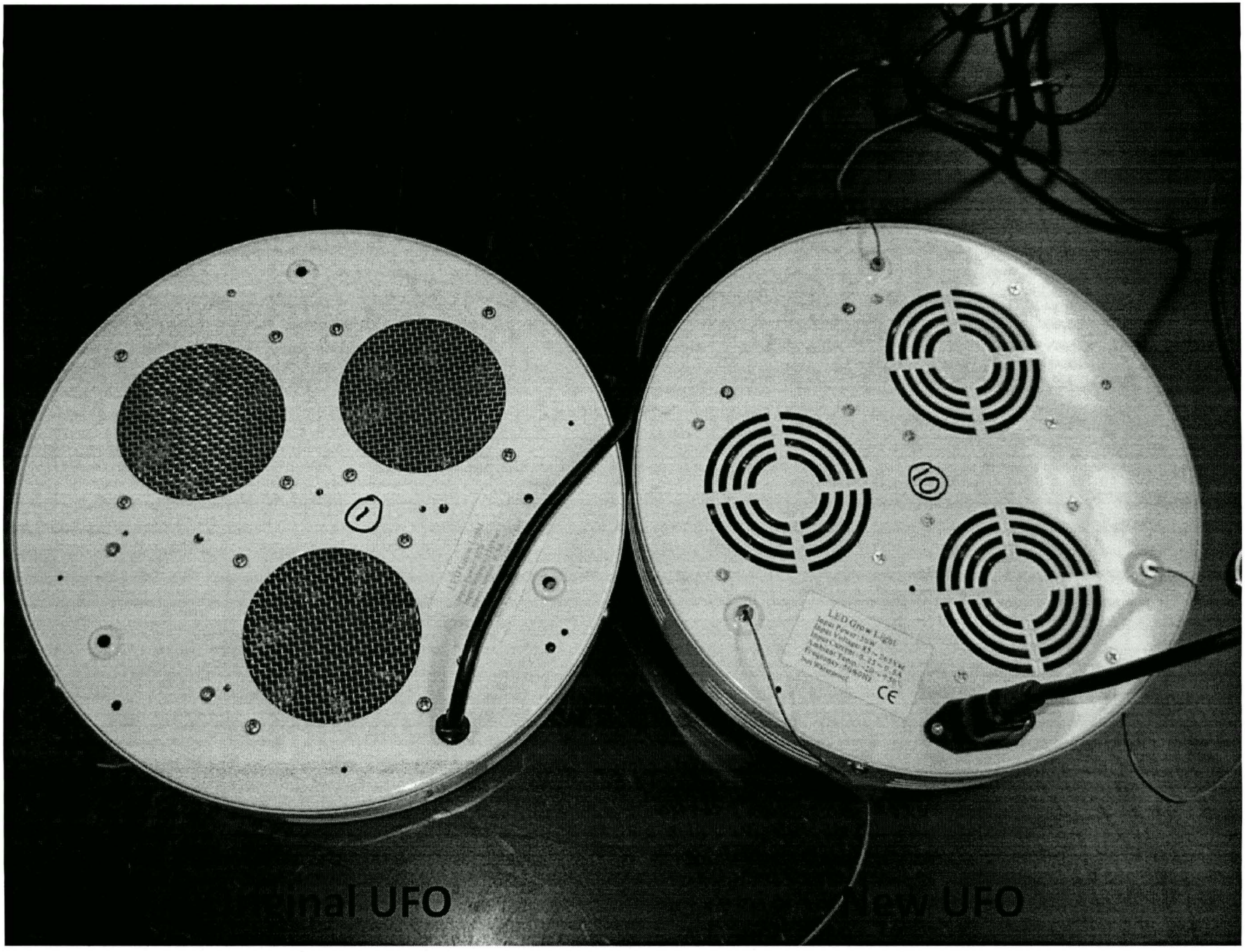
Light Uniformity - Large UFO



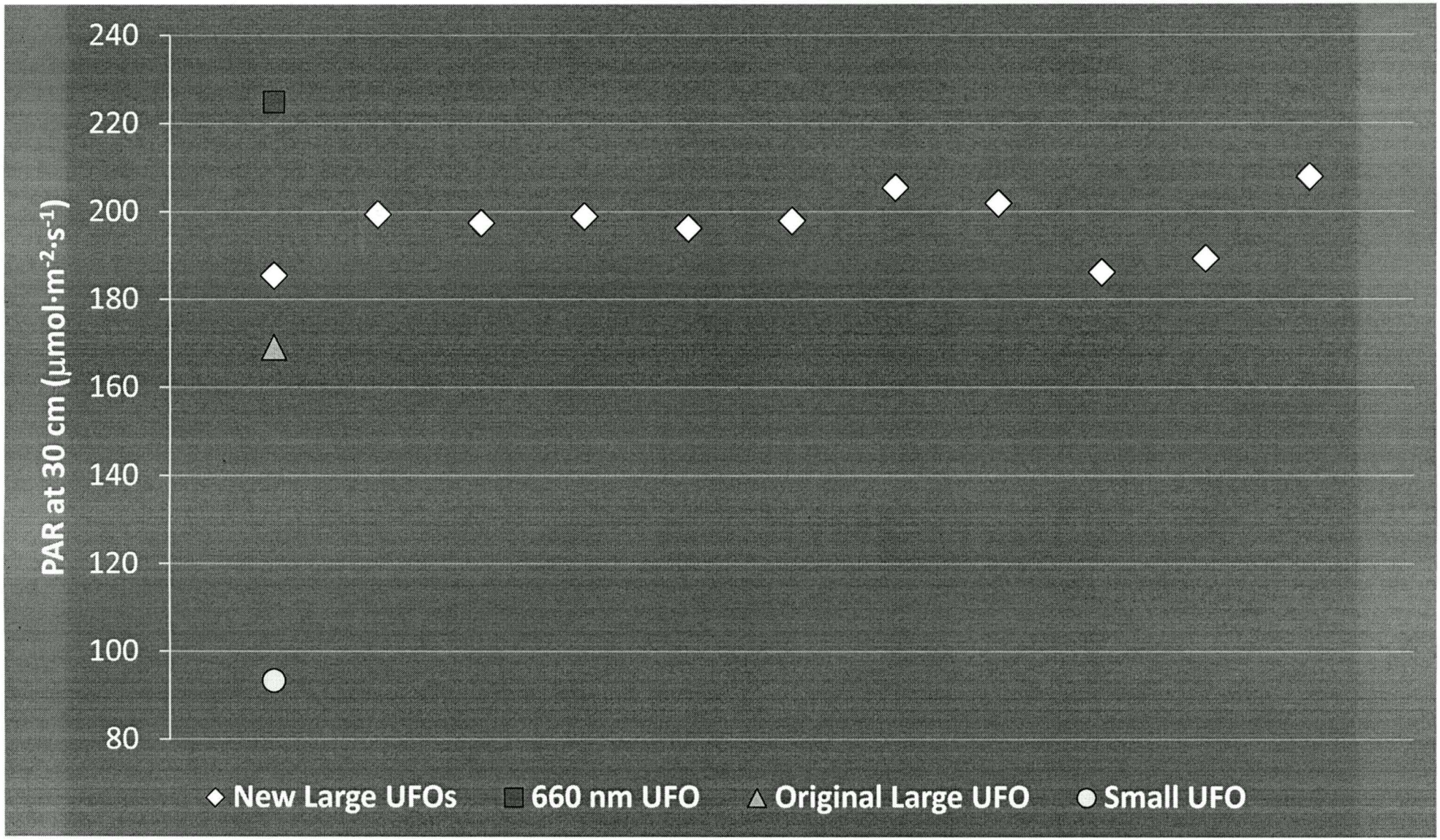
Additional large UFOs were purchased for HDU field test……

Visual inspection for uniformity

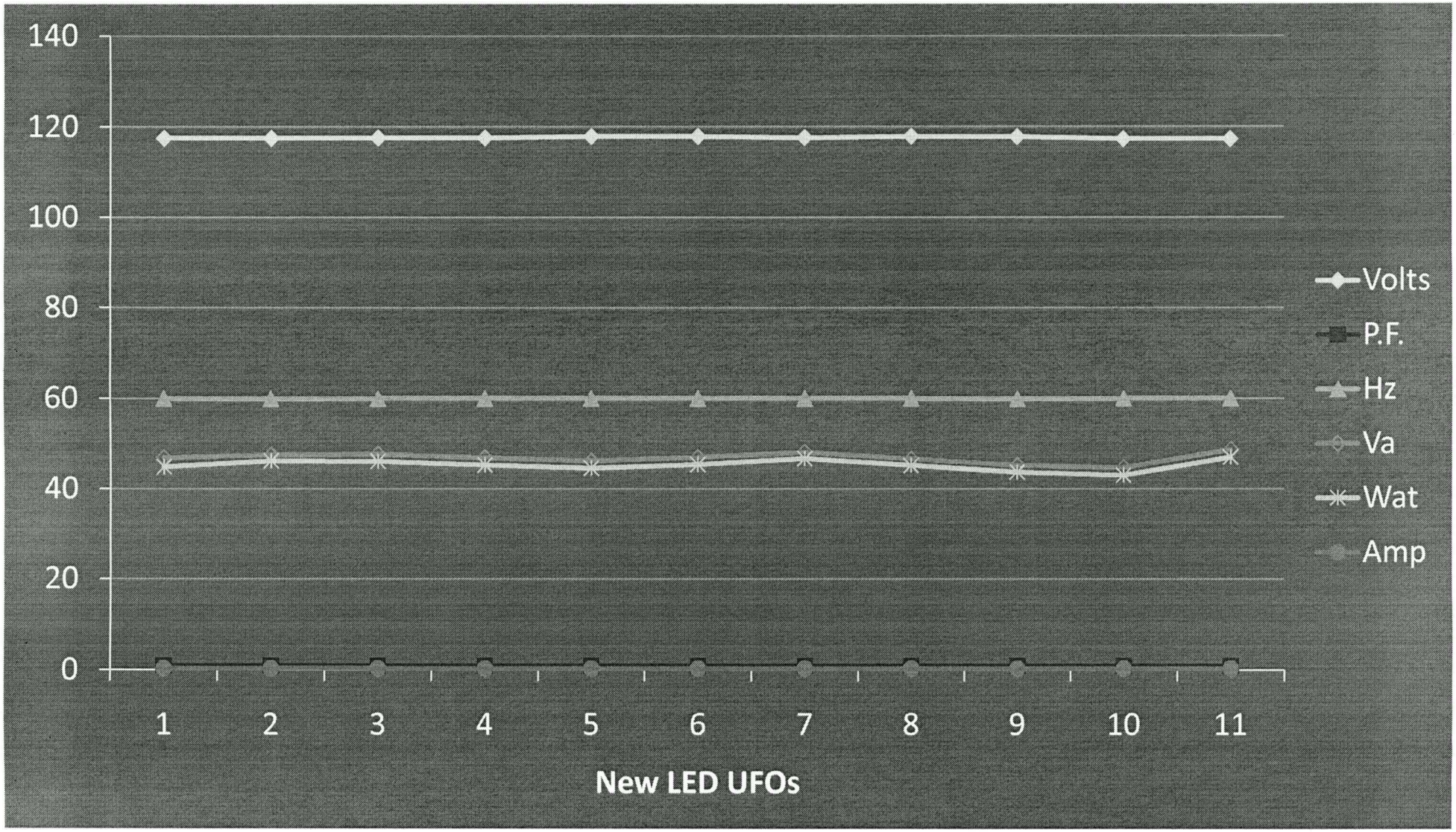



inal UFO
w UFO

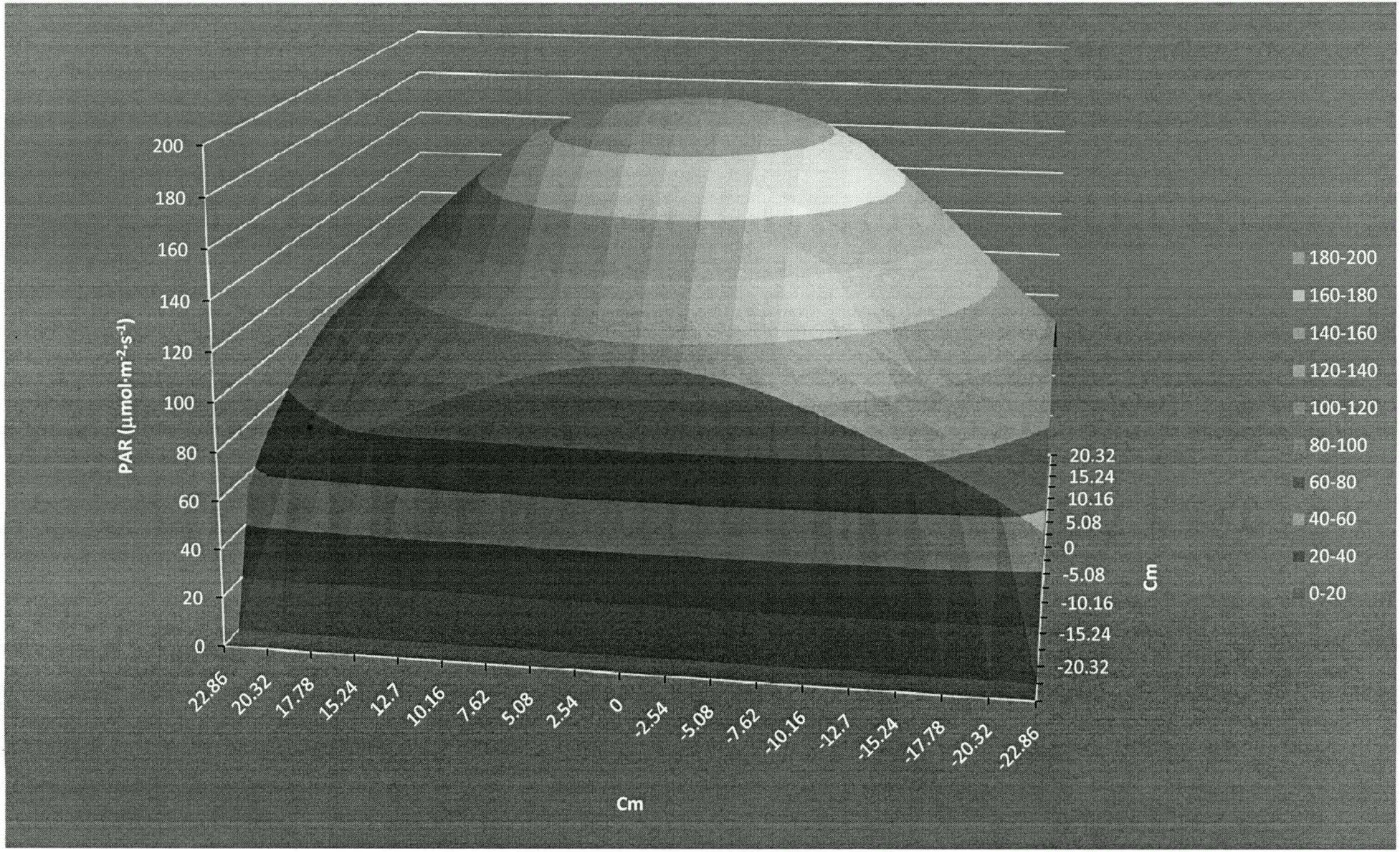
New Lamp Uniformity



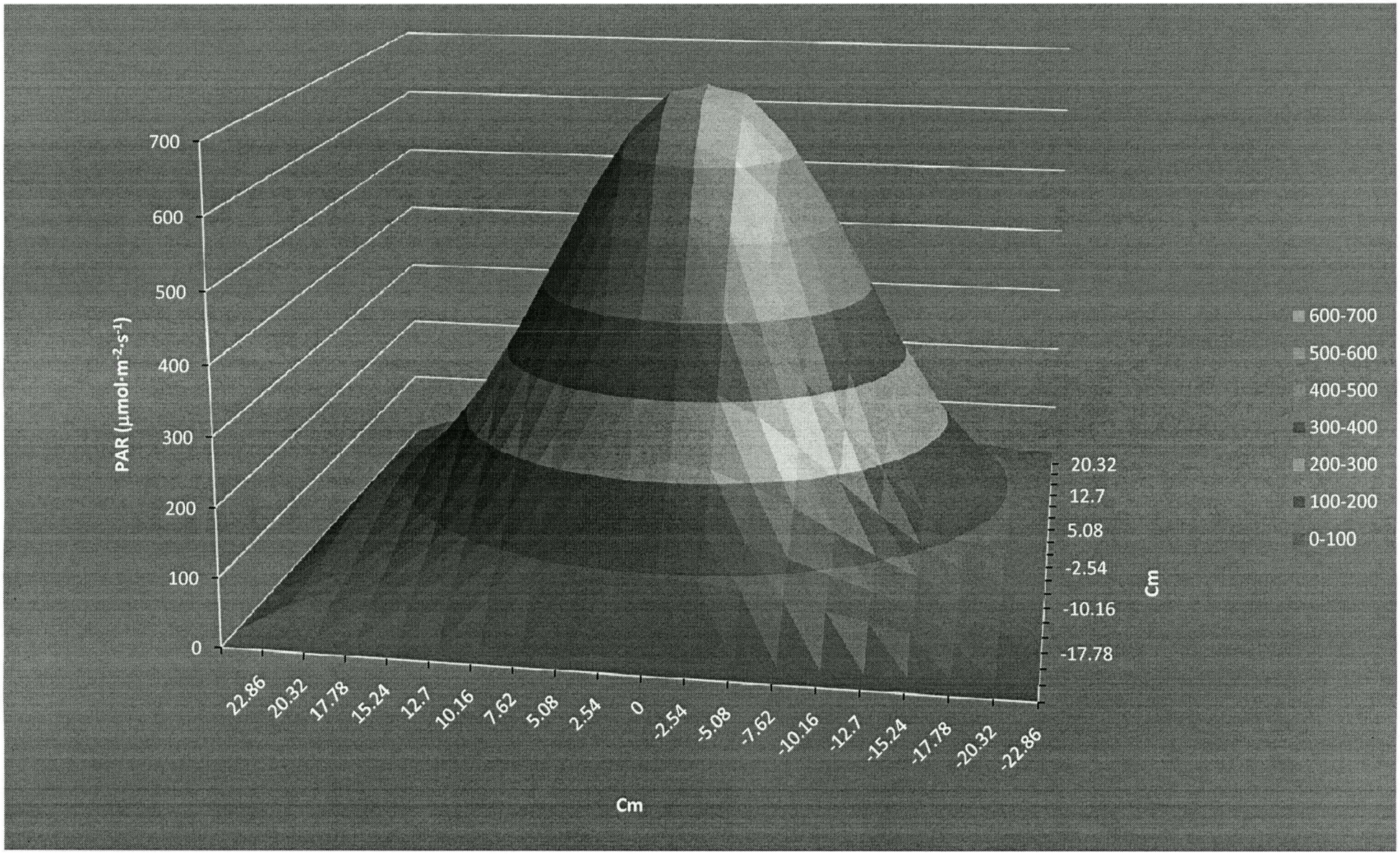
Electricity Usage data (Kill-A-Watt)



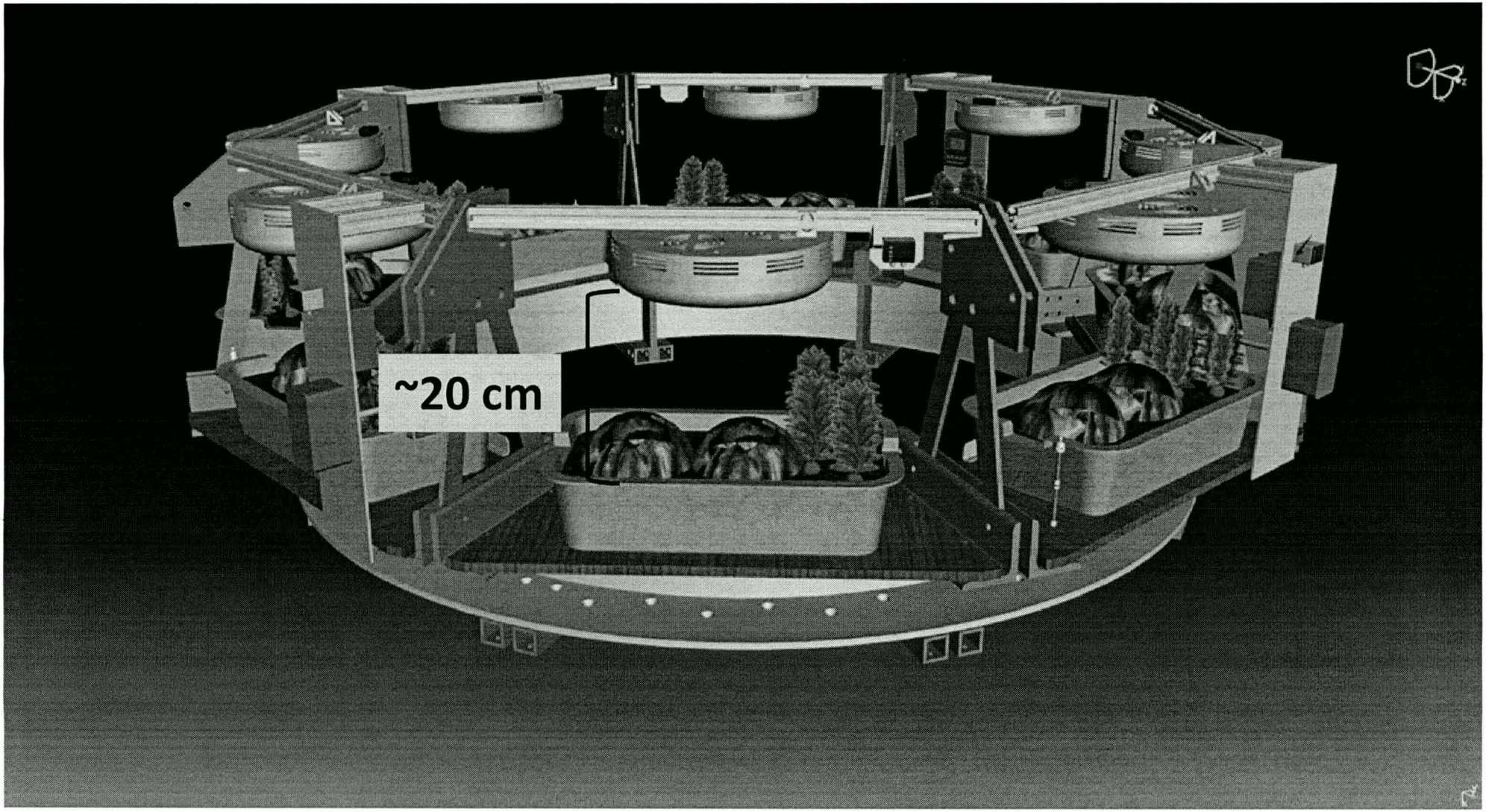
UFO Light Distribution – 30 cm



UFO Light Distribution – 15 cm



Atrium Configuration



Crew interacting with plants in HDU

Overall Conclusions

- The AIBC lights were affordable and have good uniformity within a batch
- The small UFO has ~45% lower light output than the larger UFO
- The 660 nm version has 14% greater light output than the 630 nm UFO
- Steep drop off in intensity from center when UFO is low

Desired Features: Next Gen Lighting

- Dimming capabilities
- RGB or W LEDs
- Lower profile = more vertical distance
- Integrated mounting
- Rectangular or trapezoidal shape
- Enhanced light uniformity – no dark corners
  - Reflectors or screens

Acknowledgements

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